

CREATE A MEASUREMENT PACKET GROUP CONTAINING A SET OF MEASUREMENT PACKETS, EACH MEASUREMENT PACKET IN THE MEASUREMENT PACKET GROUP CONTAINING A RESPECTIVE MEASUREMENT PACKET IDENTITY RELATIVE TO OTHER MEASUREMENT PACKETS IN THE MEASUREMENT PACKET GROUP AND CONTAINING AT LEAST ONE MEASUREMENT PERFORMANCE METRIC ASSOCIATED WITH THE INITIATOR AGENT



201

FORWARD EACH MEASUREMENT PACKET IN THE MEASUREMENT PACKET GROUP TO A TARGET AGENT OVER A COMMUNICATIONS NETWORK SUPPORTING COMMUNICATION BETWEEN THE INITIATOR AGENT AND THE TARGET AGENT



202

RECEIVE A MEASUREMENT PACKET GROUP CONTAINING A SET OF MEASUREMENT PACKETS, EACH MEASUREMENT PACKET IN THE MEASUREMENT PACKET GROUP CONTAINING A RESPECTIVE MEASUREMENT PACKET IDENTITY RELATIVE TO OTHER MEASUREMENT PACKETS IN THE MEASUREMENT PACKET GROUP AND CONTAINING AT LEAST ONE MEASUREMENT PERFORMANCE METRIC ASSOCIATED WITH THE INITIATOR AGENT



CALCULATE AT LEAST ONE TARGET PERFORMANCE METRIC FOR EACH MEASUREMENT PACKET RECEIVED IN THE MEASUREMENT PACKET GROUP, THE AT LEAST ONE TARGET PERFORMANCE METRIC CALCULATED USING THE MEASUREMENT PERFORMANCE METRIC AND MEASUREMENT PACKET IDENTITY FROM A CORRESPONDING MEASUREMENT PACKET OF THE MEASUREMENT PACKET GROUP, THE AT LEAST ONE TARGET PERFORMANCE METRIC IDENTIFYING A PACKET LATENCY AND PACKET LOSS METRICS FOR MEASUREMENT PACKETS TRANSFERRED BETWEEN THE INITIATOR AGENT AND TARGET AGENT



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CREATE A RESPONSE PACKET GROUP CONTAINING A SET OF RESPONSE PACKETS, EACH RESPONSE PACKET CONTAINING THE AT LEAST ONE TARGET PERFORMANCE METRIC CALCULATED BY THE TARGET AGENT USING THE MEASUREMENT PERFORMANCE METRIC FROM A CORRESPONDING MEASUREMENT PACKET OF THE MEASUREMENT PACKET GROUP



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FORWARD EACH RESPONSE PACKET IN THE RESPONSE PACKET GROUP TO THE INITIATOR AGENT OVER A COMMUNICATIONS NETWORK SUPPORTING COMMUNICATION BETWEEN THE INITIATOR AGENT AND THE TARGET AGENT



RECEIVE A RESPONSE PACKET GROUP CONTAINING A SET OF RESPONSE PACKETS FROM THE TARGET AGENT, EACH RESPONSE PACKET CONTAINING AT LEAST ONE TARGET PERFORMANCE METRIC CALCULATED BY THE TARGET AGENT USING THE MEASUREMENT PERFORMANCE METRIC IN A CORRESPONDING MEASUREMENT PACKET OF THE MEASUREMENT PACKET GROUP



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CALCULATE AT LEAST ONE NETWORK LINK METRIC FROM THE AT LEAST ONE TARGET PERFORMANCE METRIC IN EACH RESPONSE PACKET OF THE RESPONSE PACKET GROUP, THE AT LEAST ONE NETWORK LINK METRIC IDENTIFYING A PACKET LATENCY AND PACKET LOSS RATE BETWEEN THE INITIATOR AGENT AND TARGET AGENT

CREATE A MEASUREMENT PACKET GROUP CONTAINING A SET OF MEASUREMENT PACKETS

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CALCULATE A MEASUREMENT SEQUENCE NUMBER FOR THAT MEASUREMENT PACKET THAT INDICATES THE MEASUREMENT PACKET IDENTITY RELATIVE TO A TOTAL NUMBER OF MEASUREMENT PACKETS TO BE CREATED WITHIN THE MEASUREMENT PACKET GROUP

222

INSERT THE MEASUREMENT SEQUENCE NUMBER FOR THAT MEASUREMENT PACKET INTO THE MEASUREMENT PACKET

223

INSERT A MEASUREMENT GROUP COUNT INTO THE MEASUREMENT PACKET, THE MEASUREMENT GROUP COUNT INDICATING THE TOTAL NUMBER OF MEASUREMENT PACKETS TO BE CREATED WITHIN THE MEASUREMENT PACKET GROUP

201

FORWARD EACH MEASUREMENT PACKET TO A TARGET AGENT

224

GENERATE A MEASUREMENT TRANSMIT TIMESTAMP FOR THAT MEASUREMENT PACKET

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225

INSERTING THE MEASUREMENT TRANSMIT TIMESTAMP AS THE MEASUREMENT PERFORMANCE METRIC INTO THE MEASUREMENT PACKET

226

TRANSMIT THE MEASUREMENT PACKET CONTAINING THE SEQUENCE NUMBER FOR THAT MEASUREMENT PACKET, THE GROUP COUNT, AND THE MEASUREMENT TRANSMIT TIMESTAMP TO THE TARGET AGENT

227

FOR EACH MEASUREMENT PACKET, INSERT AN AMOUNT OF PAYLOAD DATA INTO THE MEASUREMENT PACKET

<u>Y</u>

INSERT A INITIATOR COMMUNICATIONS PORT IDENTITY INTO EACH MEASUREMENT PACKET ALLOWING THE TARGET AGENT TO IDENTIFY A COMMUNICATIONS PORT ON THE INITIATOR AGENT TO WHICH TO TRANSMIT RESPONSE PACKETS IN RESPONSE TO

RECEIVING EACH MEASUREMENT PACKET

229

OPEN A COMMUNICATIONS PORT FOR RECEPTION OF RESPONSE PACKETS IN THE RESPONSE PACKET GROUP, THE COMMUNICATIONS PORT CORRESPONDING TO THE INITIATOR COMMUNICATIONS PORT IDENTITY SPECIFIED IN THE MEASUREMENT PACKETS OF THE MEASUREMENT PACKET GROUP

RECEIVE A MEASUREMENT PACKET GROUP CONTAINING A SET OF MEASUREMENT PACKETS,
EACH MEASUREMENT PACKET IN THE MEASUREMENT PACKET GROUP CONTAINING A
RESPECTIVE MEASUREMENT PACKET IDENTITY RELATIVE TO OTHER MEASUREMENT PACKETS
IN THE MEASUREMENT PACKET GROUP AND CONTAINING AT LEAST ONE MEASUREMENT
PERFORMANCE METRIC ASSOCIATED WITH THE INITIATOR AGENT

230

GENERATE A TARGET PROCESSING TIMESTAMP UPON RECEIPT OF THE MEASUREMENT PACKET, THE TARGET PROCESSING TIMESTAMP ASSOCIATED WITH THE MEASUREMENT PACKET RECEIVED AND INDICATING A TIME AT WHICH THE TARGET AGENT RECEIVES THE MEASUREMENT PACKET

231

OBTAIN A MEASUREMENT GROUP COUNT FROM THE MEASUREMENT PACKET, THE MEASUREMENT GROUP COUNT INDICATING THE TOTAL NUMBER OF MEASUREMENT PACKETS TO BE RECEIVED WITHIN THE MEASUREMENT PACKET GROUP

232

OBTAIN A MEASUREMENT SEQUENCE NUMBER FROM THAT MEASUREMENT PACKET, THE MEASUREMENT SEQUENCE NUMBER INDICATING THE MEASUREMENT PACKET IDENTITY OF THAT MEASUREMENT PACKET RELATIVE TO A TOTAL NUMBER OF MEASUREMENT PACKETS TO BE CREATED WITHIN THE MEASUREMENT PACKET GROUP AS INDICATED BY THE MEASUREMENT GROUP COUNT

233

OBTAIN A MEASUREMENT TRANSMIT TIMESTAMP AS THE MEASUREMENT PERFORMANCE METRIC FROM THE MEASUREMENT PACKET, THE MEASUREMENT TRANSMIT TIMESTAMP INDICATING A TIME AT WHICH THE INITIATIOR AGENT TRANSMITTED THE MEASUREMENT PACKET TO THE TARGET AGENT

CALCULATE AT LEAST ONE TARGET PERFORMANCE METRIC FOR EACH MEASUREMENT PACKET RECEIVED IN THE MEASUREMENT PACKET GROUP

234

CALCULATE, AS THE AT LEAST ONE NETWORK LINK METRIC IN ASSOCIATION WITH THE MEASUREMENT PACKET, A MEASUREMENT PACKET ONE WAY TRAVEL TIME BETWEEN THE INITIATOR AGENT AND THE TARGET AGENT AS A TIME DIFFERENCE BETWEEN THE MEASUREMENT TRANSMIT TIMESTAMP FOR A MEASUREMENT PACKET THAT CORRESPONDS WITH THE RECEIVED RESPONSE PACKET AND THE TARGET PROCESSING TIMESTAMP THAT THE TARGET AGENT GENERATES UPON RECEIPT OF THE MEASUREMENT PACKET

235

IDENTIFY A COMPLETION EVENT FOR RECEIPT OF THE MEASUREMENT PACKET GROUP

236

CALCULATE A PACKET LOSS METRIC OF PACKETS LOST IN TRANSMISSION BETWEEN THE INITIATOR AGENT AND TARGET AGENT BASED UPON RECEIVED MEASUREMENT SEQUENCE NUMBERS AND A TOTAL NUMBER OF PACKETS IN A MEASUREMENT PACKET GROUP IDENTIFIED BY THE MEASUREMENT GROUP COUNT

237

CALCULATE AN AVERAGE ONE WAY TRAVEL TIME FOR MEASUREMENT PACKETS TRANSMITTED BETWEEN THE INITIATOR AGENT AND THE TARGET AGENT IN THE MEASUREMENT PACKET GROUP BY AVERAGING THE MEASUREMENT PACKET ONE WAY TRAVEL TIME ACROSS A NUMBER OF MEASUREMENT PACKETS RECEIVED

CREATE A RESPONSE PACKET GROUP CONTAINING A SET OF RESPONSE PACKETS, EACH RESPONSE PACKET CONTAINING THE AT LEAST ONE TARGET PERFORMANCE METRIC CALCULATED BY THE TARGET AGENT USING THE MEASUREMENT PERFORMANCE METRIC FROM A CORRESPONDING MEASUREMENT PACKET OF THE MEASUREMENT PACKET GROUP

238

FOR EACH MEASUREMENT PACKET RECEIVED IN THE MEASUREMENT PACKET GROUP

239

COPY THE CONTENTS OF THAT MEASUREMENT PACKET INTO A CORRESPONDING RESPONSE PACKET GENERATED AND CORRESPONDING TO THAT MEASUREMENT PACKET

▼ 240

INSERT THE TARGET PROCESSING TIMESTAMP INTO THE RESPONSE PACKET

241

INSERT AT LEAST ONE OF THE PACKET LOSS METRIC AND THE AVERAGE ONE WAY TRAVEL TIME FOR MEASUREMENT PACKETS AS THE AT LEAST ONE TARGET PERFORMANCE METRIC WITHIN THE RESPONSE PACKET

242

PERFORM THE OPERATION OF FORWARDING THAT RESPONSE PACKET OF THE RESPONSE PACKET GROUP TO THE INITIATOR AGENT

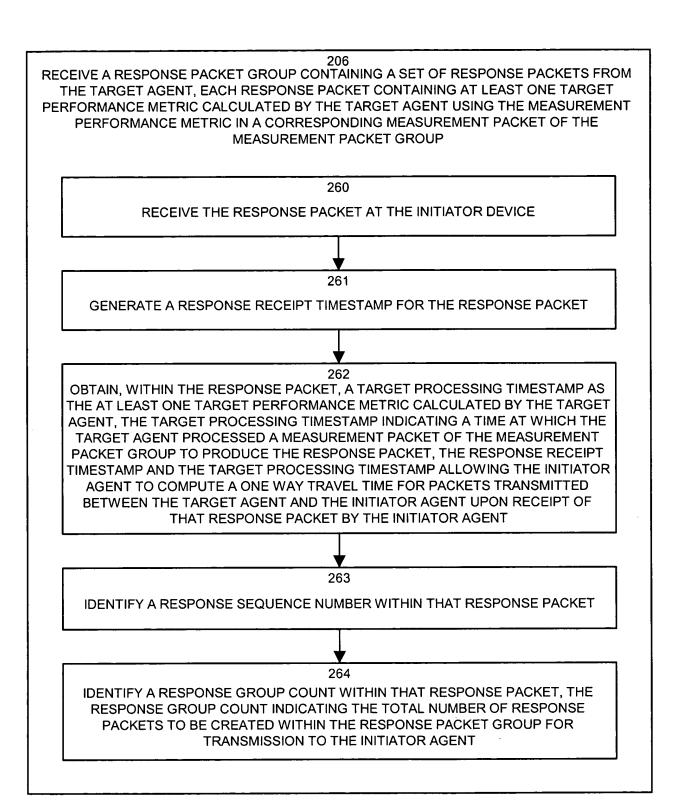


FIG. 7

CALCULATE AT LEAST ONE NETWORK LINK METRIC FROM THE AT LEAST ONE TARGET PERFORMANCE METRIC IN EACH RESPONSE PACKET OF THE RESPONSE PACKET GROUP, THE AT LEAST ONE NETWORK LINK METRIC IDENTIFYING A PACKET LATENCY AND PACKET LOSS RATE BETWEEN THE INITIATOR AGENT AND TARGET AGENT

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A RESPONSE PACKET ONE WAY TRAVEL TIME BETWEEN THE TARGET AGENT AND THE INITIATOR AGENT AS A TIME DIFFERENCE BETWEEN THE TARGET PROCESSING TIMESTAMP AND THE RESPONSE RECEIPT TIMESTAMP

266

A MEASUREMENT PACKET ONE WAY TRAVEL TIME BETWEEN THE INITIATOR AGENT AND THE TARGET AGENT AS A TIME DIFFERENCE BETWEEN THE MEASUREMENT TRANSMIT TIMESTAMP FOR A MEASUREMENT PACKET THAT CORRESPONDS WITH THE RECEIVED RESPONSE PACKET AND THE TARGET PROCESSING TIMESTAMP THAT THE TARGET AGENT INCLUDES WITHIN THE RESPONSE PACKET

267

A ROUND TRIP TRAVEL TIME FOR TRANSMISSION OF A MEASUREMENT PACKET FROM THE INITIATOR AGENT TO THE TARGET AGENT AND RECEIPT OF A CORRESPONDING RESPONSE PACKET TRANSMITTED FROM THE TARGET AGENT TO THE INITIATOR AGENT

268

IDENTIFY A COMPLETION EVENT FOR RECEIPT OF THE RESPONSE PACKET GROUP

269

CALCULATE AN AVERAGE ONE WAY TRAVEL TIME BETWEEN THE INITIATOR AGENT AND THE TARGET AGENT FOR PACKETS IN AT LEAST ONE OF MEASUREMENT PACKET GROUP

AND THE RESPONSE PACKET GROUP

270

CALCULATE AN AVERAGE ROUND TRIP TRAVEL TIME FOR TRANSMISSION OF A MEASUREMENT PACKET IN THE MEASUREMENT PACKET GROUP SENT FROM THE INITIATOR AGENT TO THE TARGET AGENT AND FOR RECEIPT OF CORRESPONDING RESPONSE PACKETS IN THE RESPONSE PACKET GROUP THAT WERE TRANSMITTED FROM THE TARGET AGENT TO THE INITIATOR AGENT

271

DETERMINE AT LEAST ONE PACKET LOSS METRIC OF PACKETS LOST IN TRANSMISSION BETWEEN THE INITIATOR AGENT AND TARGET AGENT BASED UPON RECEIVED RESPONSE SEQUENCE NUMBERS AND A TOTAL NUMBER OF PACKETS IN A PACKET GROUP IDENTIFIED BY THE RESPONSE GROUP COUNT

272

CLOSE THE COMMUNICATIONS PORT TO PREVENT UNAUTHORIZED COMMUNICATIONS ON THE COMMUNICATIONS PORT DURING TIMES WHEN NO RESPONSE PACKETS ARE EXPECTED